CLAIMS

What is claimed is:

1. In a downflow vessel containing a filter bed having a top surface and containing liquid comprising solids that settle on said top surface, the vessel further having a vessel effluent outlet in or beneath the filter bed, the improvement comprising:

a dislodging member in the vessel adapted to move across said top surface to dislodge a portion of said solids that settle on said top surface, to uncover at least a portion of said top surface for access by said liquid so that liquid flows through the filter bed and to the vessel effluent outlet.

2. In the vessel of Claim 1, the improvement further comprising an arm that rotates on a plane generally parallel to said top surface, wherein the dislodging member is pivotally connected to the arm.

3. In the vessel of Claim 1, the improvement further comprising an arm that rotates on a plane generally parallel to said top surface, wherein the dislodging member is flexibly connected to the arm.

4. In the vessel of Claim 1, the improvement further comprising an arm that rotates on a plane generally parallel to said top surface, wherein the dislodging member is rigidly connected to the arm.

5. In the vessel of Claim 1, the improvement further comprising the dislodging member being V-shaped and having a front ridge for moving forward into the solids on the top surface.

6. In the vessel of Claim 1, wherein the vessel is a sludge blanket reactor and the liquid comprising solids is mixed liquor being microbially-remediated in said reactor.

7. In the vessel of Claim 6, wherein the solids settling on said top surface form a sludge mat of 2 - 20 wt-% percent solids in water and the dislodging member moves through and dislodges the sludge mat.

8. In the vessel of Claim 7, wherein the filter bed is particulate selected from the group consisting of sand, pebbles, and carbon.

9. In a downflow microbial waste remediation reactor containing mixed liquor comprised of water, waste solids, and microbes, and the reactor having a filter bed with a filter bed top surface upon which a portion of said waste solids and microbes settle to form a sludge mat, the improvement comprising:

a sludge mat dislodging system comprising a member positioned at or near said top surface in contact with the sludge mat and adapted to move generally parallel to the top surface through the sludge mat in a direction of forward movement to dislodge at least a part of the sludge mat from the top surface.

10. In the reactor of Claim 9, the improvement further comprising the member being adapted to have at least one generally vertical side that is at an angle to the direction of forward movement so that it is adapted to push sludge mat aside.

11. In the reactor of Claim 10, the improvement further comprising the member being V-shaped.

12. In the reactor of Claim 9, the improvement further comprising at least one arm rotatably mounted in the reactor, and said dislodging member being connected to the arm so that the arm moves the member through the reactor.

13. In the reactor of Claim 12, the improvement further comprising two of said arms, wherein each of said arms comprises at least one of said dislodging members.

14. In the reactor of Claim 9, wherein the mixed liquor comprises less than 2 wt-% solids in water and said sludge mat is 2 - 20 wt-% solids in water.

15. A method of operating a sludge blanket microbial reactor to remediate a waste stream, the method comprising:

providing a filter bed with a top surface in a reactor;

providing a mixed liquor in the reactor comprising water, suspended solids, and microbes, wherein some of said suspended solids and microbes settle out of solution onto the top surface of the filter bed to form a sludge mat that is relatively dry compared to said mixed liquor, wherein the sludge mat restricts flow of liquid into the filter bed;

moving a dislodging member across the top of the filter bed in a path to dislodge said sludge mat from said path, so that liquid can access the filter bed for filtration and exit the reactor;

wherein said moving a dislodging is done while said waste stream is flowing into the reactor and liquid effluent is exiting the reactor.

16. A method as in Claim 15, further comprising providing an arm carrying the dislodging member, and rotating the arm in the reactor generally parallel to the top surface.

17. A method as in Claim 16, wherein rotating the arm comprises pumping liquid through a propulsion opening in a trailing side of the arm.

18. A method as in Claim 15, further comprising providing a filter bed stirring member inside the filter bed, and intermittently stirring the filter bed with the stirring member.

19. A method as in Claim 18, comprising operating the reactor in a first period comprising said moving the dislodging member across the top of the filter bed and comprising a second period comprising stopping said moving of the dislodging member, stopping

liquid flow out of the reactor from the filter bed, and performing said stirring of the filter bed to fluidize the filter bed.

20. A method as in Claim 15, wherein the dislodging member is V-shaped with a ridge and two slanted sides and wherein moving the dislodging member comprises moving the member so that the ridge moves forward into the sludge mat and the sludge slides aside on said two slanted sides.

21. A method as in Claim 16, wherein moving said dislodging member comprises pulling a top portion of said member forward with said arm so that a lower portion of said member slides along the filter bed behind the arm.